2003 NSLS Annual Awards Ceremony and Picnic

September 17, 2003

On Wednesday, September 17, the NSLS had its annual Awards Ceremony and Picnic. Despite the impending arrival of Hurricane Isabel, the weather was spectacular and the pig roast was another big success. The picnic was coordinated by Laura Miller and executed by a number of NSLS staff members, including Charlie Nielson, Boyzie Singh, Bob Best, Joe Greco, Paul Humbert, Jim Lacy, Jim Newburgh, John Burke, Gerry Van Derlaske, and Bob Kiss, along with Ken Sutter "the pigman."

This year, Service Awards were given to 24 NSLS staff members: Al Almasy, Sam Krinsky, and Bob Casey (30 years); Roy D'Alsace, Walter De Boer, John Gallagher, Rick Greene, Chris Lanni, Payman Mortazavi, Jack Tallent, Frank Terrano, and Gerry VanDerlaske (25 years); Diane Hatton, Steve Hulbert, Jim Murphy, and Florin Staicu (20 years); Peter Gross, Alan Levine, Paul Montanez, Pauline Pearson, Eva Rothman, Brian Sheehy, Chris Stelmach, and Xijie Wang (10 years).

Spotlight Awards were presented to NSLS staff members for the completion of extraordinary accomplishments that were of significant benefit to the Department, Division, or Laboratory. This year's Spotlight Award winners were: (1) Brian Kushner for getting the x-ray ring's digital vertical feedback up and running, (2) Jim Newburgh for outstanding radio frequency cavity installation efforts during the winter 2002 shutdown, (3) Jack Tallent for designing a new beam profile monitor for the x-ray ring, (4) John Burke for completely rebuilding the fire-damaged Pulse Forming Network (PFN) section of the SDL modulator-A, and (5) Gary Nintzel for preparation, dismantling, and shipping of the U6 beamline.

—Lisa Miller

NSLS Physicist Wins 2003 Free Electron Laser Prize

October 10, 2003

Li Hua Yu, a physicist at the NSLS won the 2003 Free Electron Laser (FEL) Prize sponsored by the 25th International Free Electron Laser Conference. Yu received the award, which consists of $3,000, a certificate and a plaque, at the FEL conference held this year in Tsukuba, Japan.

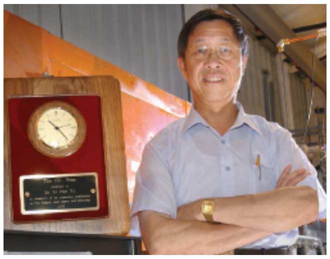
NSLS Chairman Steve Dierker presented the Service and Spotlight Awards at the Annual Picnic.

Yu's award was given "in recognition of his outstanding contributions to FEL science and technology." Over the last 20 years, Yu and colleagues from Brookhaven contributed significantly in developing two types of lasers that are important for scientific investigations: the self-amplified spontaneous emission free electron laser (SASE FEL), and the high gain harmonic generation free electron laser (HGHG FEL).

NSLS Staff enjoying the barbeque.

In the SASE process, the light the laser emits for experiments starts from noise, or random signals. In contrast, in the HGHG process, the output light starts from fast-moving electrons interacting with a seeding laser that shifts the light to a higher frequency and makes it significantly more coherent, meaning electrons move in a coordinated way to emit light. The intense light of the HGHG FEL reveals the fine details of atomic interactions inside materials and the very fast motions of molecules in chemical reactions, all with an unsurpassed precision.

Yu explained, "The HGHG FEL combines the intensity and coherence of a laser with the broad spectrum of light available in a synchrotron, a type of accelerator. The invention of the laser provided a revolutionary source of coherent light that created many new fields of scientific research. The development of the HGHG FEL extends the reach of lasers to much shorter wavelengths, thus opening new research opportunities."



Li Hua Yu with FEL Prize

Yu continued, "I am very happy to

receive this award, and I am grateful for Brookhaven Lab's support and the excellent team who worked with me to make the HGHG FEL at Brookhaven the first and only one of its kind in the world."

At Brookhaven's Accelerator Test Facility in 1999, Brookhaven scientists, in collaboration with Argonne National Laboratory researchers, verified the theoretical foundation of the HGHG FEL operating in the infrared region of the light spectrum. In 2002, the technique was further developed to enable the HGHG FEL at Brookhaven to produce shorter wavelength light in the deep ultraviolet spectral region. This enabled researchers to perform new chemistry experiments.

The HGHG FEL may be a complementary research tool to synchrotrons around the world, including the Brookhaven's Laboratory Directed Research and Development Program, the U.S. Naval Research Laboratory, and the U.S. Air Force funded Yu's research on the DUV-FEL.

Li Hua Yu earned his undergraduate degree from Jilin University in China in 1970. He earned both an M.S. and Ph.D. in physics from Stony Brook University in 1980 and 1984, respectively. In 1984, he joined Brookhaven Lab as a research associate, and he rose through the ranks to become a senior physicist, in 2000. With a team of eight scientists and engineers from Brookhaven, Yu won an R&D 100 Award from R&D Magazine in 1989 for inventing the Real-Time Harmonic Closed-Orbit Feedback System, which stabilizes the orbit of electron beams in synchrotrons.

—Diane Greenberg

2003 Nobel Prize in Chemistry Awarded to NSLS User Roderick MacKinnon

October 8, 2003

Roderick MacKinnon, M.D., frequent NSLS user, won half of this year's Nobel Prize in Chemistry for work explaining how a class of proteins helps to generate nerve impulses -- the electrical activity that underlies all movement, sensation, and perhaps even thought. The work leading to the prize was done primarily at the Cornell High Energy Synchrotron Source and the National Synchrotron Light Source.

The proteins, called ion channels, are tiny pores that stud the surface of all of our cells. These channels allow the passage of potassium, calcium, sodium, and chloride molecules called ions. Rapid-fire opening and closing of these channels releases ions, moving electrical impulses from the brain in a wave to their destination in the body.

Starting in 1998, after 10 years studying the biophysics of ion channels, MacKinnon published a series of structural solutions — high-resolution molecular-level "snapshots" of ion channels, produced at Cornell and Brookhaven. These structures literally showed the scientific community how electrical signaling occurs.

MacKinnon, a biophysicist and self-taught x-ray crystallographer, is a professor at Rockefeller University and an investigator at the Howard Hughes Medical Institute. He shares this year's chemistry Nobel with Peter Agre, M.D., of Johns Hopkins University School of Medicine.

[Editor's note: For more information on MacKinnon's work, see the related Feature Highlight beginning on page 2-10]

—Karen McNulty Walsh

Rod MacKinnon. Photo courtesy of Chris Denney for the Howard Hughes Medical Institute, ©2003.

NSLS Shines Light on Disease

October 23, 2003

A group of four BNL scientists investigating the underpinnings of diseases from osteoporosis to botulism presented an overview of their work to a group of reporters in person and via live "webcast" on Thursday, October 23, at BNL. All the presenters use the extremely bright beams of energy (from infrared to x-rays) available at the NSLS.

NSLS Chair Steven Dierker gave an overview of the facility, which is used by more than 2,500 scientists from outside the Lab each year – including this year's chemistry Nobel Prize-winner, Rod MacKinnon of Rockefeller University, who used x-rays to determine the structure of proteins that help transmit nerve impulses throughout the body. Solving protein structures via the technique of x-ray crystallography can help scientists understand the proteins' functions and perhaps devise strategies to prevent them from causing disease.

That is the exact approach being pursued by the Biology Department's Walter Mangel and Subramanyam Swaminathan. Through x-ray crystallography and other techniques, Mangel has uncovered several parts of a viral enzyme that might be susceptible to antiviral drugs. "If you can block the activity of the enzyme," he says, "you can block the infection."

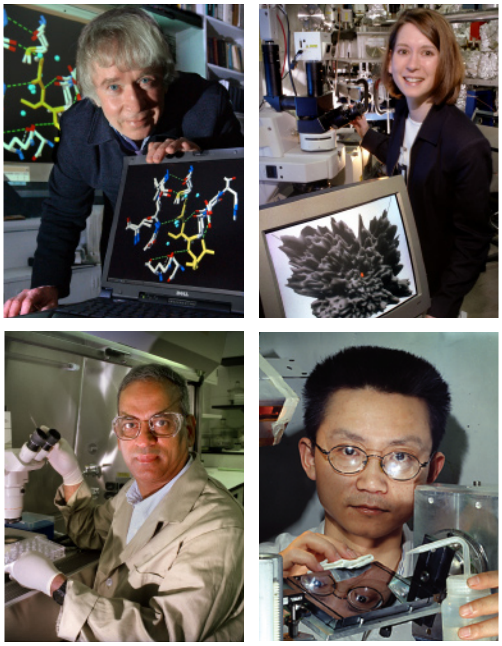
What is more, the sites Mangel has identified interact with one another. This led him to propose a new type of multi-drug therapy that viruses would not be able to "outsmart" via evolution of drug resistance. Using multiple drugs against several targets on the same enzyme might be effective against a range of viruses, including those that cause pink eye and AIDS, and against a range of bacteria, including those that cause Chlamydia, plague, and even malaria.

Swaminathan is using the NSLS x-rays to reveal components of botulinum toxin, the protein that causes botulism, that are central to its paralyzing effects. He is working to develop drugs that fit into the toxin's active sites to disrupt the potentially deadly process at three crucial steps. The result may be a vaccine and/or drugs that eliminate the toxin's potential as an agent of biowarfare or bioterrorism.

Shining the NSLS's beams on more traditional targets — bones and other body tissues — are the NSLS's biophysicist Lisa Miller and physicist Zhong Zhong. Miller is using the infrared beams to study bone composition, particularly that associated with areas of microscopic damage. She wants to know how bone composition changes in response to common osteoporosis treatments. Her work could lead to improvements in osteoporosis drugs.

Zhong uses the NSLS x-rays to look not just at bone, but at soft tissues like cartilage, blood vessels, skin, and fat deposits as well. His technique, called diffraction-enhanced imaging (DEI), uses higher energy x-rays that pass right through the sample without being absorbed, which results in a lower dose to the patient than traditional x-ray techniques. DEI makes soft tissues visible because each tissue type scatters the beam differently. A sensitive analyzer crystal can detect these subtle diffractions and translate them into different intensities, visible on x-ray film in magnificent detail. The technique could yield more accurate and earlier diagnosis of soft-tissue diseases such as breast cancer.

— Karen McNulty Walsh



(Top, from left): Walter Mangel and Lisa Miller (bottom, left) Subramanyam Swaminathan and Zhong Zhong.

389th Brookhaven Lecture 'Nanoscale Twist in Liquid Crystal Miniature Video Displays'

December 17, 2003

Recently, commercial large-viewing angle flat panel displays, as well as miniature video displays for digital cameras, camcorders, head- and helmet-mounting, have been produced using ferroelectric liquid crystal (FLC) and antiferroelectric liquid crystal (AFLC) technology.

Ron Pindak

While developing materials for these devices, researchers noticed the thermal signature of a rich variety of new intermediate phases of the liquid crystals. The structures of these intermediate phases look identical by conventional x-ray analysis and involves nanometer orientational properties that occur at smaller dimensions than can be observed using conventional optical microscopy.

To overcome this limitation of conventional investigative techniques, Ron Pindak, a physicist at the NSLS, and other researchers used a property of synchrotron x-ray sources — or more specifically, an intense beam of linearly polarized x-rays of a specific energy — to directly probe the nanometer-scale helical ordering of these new phases of liquid crystals.

Pindak gave a presentation on this research on Wednesday, December 17, at 4 p.m., the 389th Brookhaven Lecture, "Nanoscale Twist in Liquid Crystal Miniature Video Displays." Pindak was introduced by Steven Dierker, NSLS Chair and Associate Laboratory Director for Light Sources.

As Pindak explained in his talk, the x-ray scattering process is highly sensitive to the orientation of the chemical bonding of the atom, and therefore sensitive to the orientation of the molecule itself when using x-rays with an energy that excites electrons from the core of an atom within a molecule. He described how FLCs and AFLCs are used in devices and contrasted their behavior with more widely used liquid crystals.

Pindak joined BNL in 2001 as a physicist after 24 years at Bell Laboratories. Since then, he has headed the Science Program Support Section of the User Science Division, and taken the lead in developing a condensed matter program. He also served as the Interim Associate Director for the BNL Nanocenter.

Pindak received a B.S. in physics from Boston College in 1969 and a Ph.D. in physics from the University of Pennsylvania in 1975.

— Ron Pindak and John Galvin